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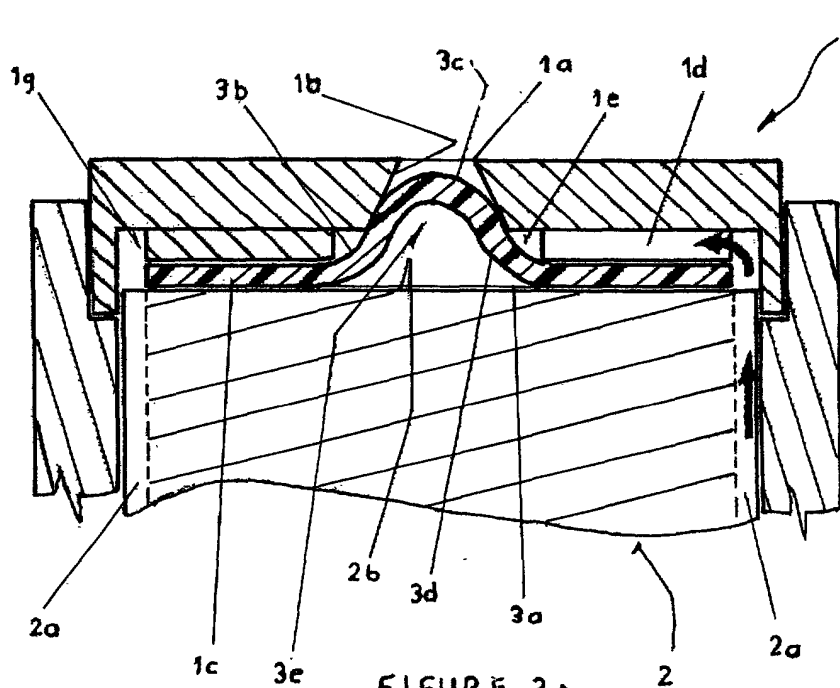
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(54) **A flexible membrane as an outlet channel stopper**

(57) An elastically flexible membrane, made of compressible resilient material is inserted between an internal surface of an orifice defining plate and the opposite surface of an insert. At its centre, the membrane has a bell-shaped dome, which abuts against the internal sur-

face of the orifice defining plate. When liquid is dispensed, the liquid pressure forces the membrane to deform, allowing the liquid to be dispensed. When liquid pressure ceases, the membrane regains its original shape, hereby sealing the orifice.



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## Description

**[0001]** The present invention relates to outlet nozzles for a fluid under pressure, specifically a flexible membrane acting as an outlet channel stopper for a nozzle that is adaptable for use in already existing spray nozzle constructions without altering or otherwise modifying the existing nozzle construction.

**[0002]** More concretely, the present invention covers improvements in flexible membranes capable of selectively regulating the hermetic closure of a fluid under pressure in outlet nozzles of the type of nozzles capable of emitting a spray cloud, a sprinkling, a definite dosage of a gel, a definite mass of a pasty liquid or cream, a drop or discharge of a gas, or a jet of a liquid according to the design of the nozzle and the result desired.

**[0003]** Nonlimiting examples simply illustrative of these functions are presented by aerosol containers or containers possessing a pump capable of creating a positive pressure in the interior of such containers and discharging the liquid in the form of a fine sprinkling such as a perfume, etc.

## FIELD OF THE INVENTION:

**[0004]** For the purposes of the present invention the following elements shall be named and identified by the terms given below:

**NOZZLE** : identifies the body that in communication with the fluid, permits discharge of the fluid in the ways indicated above.

**OUTLET HEAD**: identifies the element which contains or is connected with the pumping elements or valve at one end, whereas at its other end it contains or is connected with the nozzle. This outlet head can coincide with the operating element of the valve or pump, and it can be connected to the nozzle either directly or by means of a delivery line for the purpose.

**CONTENTS**: this defines the fluid, gas, air, or powder container within the container and intended for discharge through the nozzle.

**PACKAGE**: this term identifies as such any closed container capable of containing the contents in its interior, maintaining the contents under the pressure of another agent, such as a gas, or by subjecting the contents to the action of a pump capable of exerting pressure on the contents.

## BACKGROUND OF THE INVENTION:

**[0005]** Aerosol containers and containers possessing a pump or pumping element to deliver their contents are extensively known. These containers discharge their contents through the action of a pump or by means of the action of a gas which keeps the contents under positive pressure.

**[0006]** This is also the case when the contents are subjected to an outside pressure source.

**[0007]** The contents are usually delivered through an outlet nozzle. Nozzles generally consist of small partition walls perpendicular to the direction of the axis of the discharging fluid flow volume provided with a small hole. The inside surface of this partition wall demarcates the front surface of a small chamber within which fluid under pressure arrives from a side clearance. The interconnection between this clearance and the small chamber is attained by at least one channel that communicates between said clearance and the chamber. This channel can consist of an annular distributor, or it can consist of one or more channels which are radial or eccentric in relation to the centre of the partition wall, and which coincide with the outlet hole. This arrangement creates a whirlpool effect thereby optimising the dispersion of the sprinkling cloud. This compartment wall is suitably created by means of a part inserted into the end of the nozzle.

**[0008]** The back surface of this small chamber (considering its front surface the one nearer to the outlet orifice) is defined by an insert piece, which is an elongated element that is coaxial to the axis of the nozzle outlet orifice. The insert piece has a lateral clearance with its housing walls allowing the fluid to flow from the container toward the outlet orifice.

**[0009]** This known construction recognises as one of its main drawbacks that the closure of the container is attained in a distant position to the orifice of the outlet nozzle. For instance, this closure is known to be performed through a valve construction usually placed in a position intermediate between the container and said nozzle.

**[0010]** The contents of said container as a rule can be degraded and sometimes polymerised by prolonged contact with the air. For instance, if the contents is a lacquer, paint, or an organic formulation (medicine) the oxidation or polymerisation of the mass placed between the outlet nozzle and the inner closure valve should be avoided, specially considering that this passage sometimes can be of a significant length, hence the degraded mass of contents is significant, leading to stoppage problems stemming from polymerisation, or even toxicity or the lost therapeutic value stemming from oxidation.

**[0011]** Therefore, the ideal solution to this problem is to provide the nozzle at its outlet with stoppage or closure means of an automatic nature. Thus, when the pump is activated, the pressure from the pump acts on said means, which would release their closing pressure on the outlet orifice. As soon as the pressure is decreased or eliminated, the closure means will once again hermetically seal said outlet.

**[0012]** The prior Art recognises several constructions attempting to solve this problem. Two relevant prior art reference discuss solutions to this problem:

A) U.S. Patent n° 4,249,681, issued to Floyd R.

French. This construction depicts a manually operated sprayer for dispensing liquids from a container, having a resilient diaphragm convexed towards and in seating engagement with the dispensing orifice. The diaphragm is designed to flex out of engagement with the outlet orifice when the pressure of the liquid in the pump chamber exceeds the engaging force of the diaphragm.

To this end said resilient diaphragm is made out of a moulded plastic convex hemisphere, which is integral to a dispenser insert having the dispensing orifice 68 and pressed in engagement against the orifice 68 by a stationary partition 61, belonging to the cylinder walls of the pump.

B) French Patent FR 2,524,348, to MICHEL RAMIS. This reference also provides the outlet orifice with stopping means, but of an even more radical nature. At Figure 3 of RAMIS, the patent discloses an open-base cylinder with a convex integral diaphragm 20, retained in its convexed (closure) position by means of a complementary shaped jacket 21 which abuts against the insert 22 having the exit orifice.

**[0013]** The most commonly known pressure fluid dispensers each have at its exit nozzle a quite simple construction, which is depicted as part of Figure 1 :

- a) an outlet plate (10), with an outlet orifice (11) communicating with an outlet duct provided in plate (10) and secured to an outlet nozzle (1);
- b) at least one collecting groove (12) performed in the inner surface of plate (10) and connecting the periphery (13) of said inner surface of plate (10) with said outlet orifice (11);
- c) an insert body (20) of cylindrical shape, placed into a cavity (2) of the head of exit nozzle (1), coaxial to orifice (11) of plate (10), determining the cylindrical walls (21) of the lateral surface of insert (20) at least a passage (22) with said cavity, communicating this passage with a pump (not shown) and with the peripheral channel (13). The inner face of the outlet plate (10) abuts and is generally pressed against the foremost surface (23) of the insert body (20), thus defining the collecting channels (24) when faced with said grooves (12).

**[0014]** The above said construction is herein referred to as "most commonly known nozzles" and they constitute a standard in this art area. Millions of these "most commonly known nozzles" are manufactured daily, and may be found in perfume, medicinal, cosmetic and household cleansing fluids containers.

**[0015]** French and Ramis each provides a sealing and closing action against an outlet orifice, but neither construction is adaptable to the existing "most commonly known nozzles". In fact, both prior art constructions must be specifically moulded and their components are not interchangeable or adaptable to these "most com-

monly known nozzles".

**[0016]** It is impossible to place any of the components into the "most commonly known nozzles" because they simply will not fit, owing to the fact that what French and Ramis are specific constructions needing an extensive redesign of the spraying nozzle head, hence the known prior art will not provide closing and sealing means capable to operate against the outlet orifice in the "most commonly known nozzles" constructions.

#### OBJECT OF THE INVENTION:

**[0017]** It is an object of this invention to make an elastically flexible membrane which is plane-shaped at its annular perimetral area, capable of providing a sealing and closing means acting directly against the outlet orifice of a nozzle placed in connection to an outlet head for a fluid under pressure, where this membrane is capable of being introduced into any of the "most commonly known nozzles" as above defined, without introducing any modification in these "most commonly known nozzles", or in their functions or results.

**[0018]** It is also an object for this invention to make a membrane which is capable of adapting itself to any irregularity to be found in the abutting surfaces of the insert and plate, creating an annular seal between said surfaces.

**[0019]** It is also an object of this invention to make a membrane capable of establishing between it and the abutting surfaces of the insert against which it perimetally rests, a small air containing deformable sealed chamber that deforms when the membrane is deformed and is capable of compressing the volume of air therein enclosed.

**[0020]** It is another object of this invention to make a membrane which is rendered plane within said hermetic chamber, freeing the passage of communication with the outlet orifice.

**[0021]** It is still another object of this invention to make a membrane which can be constructed with a material different from the material from which said outlet nozzle, plate and insert are formed

**[0022]** It is a further object for this invention, that said membrane is capable of having its thickness reduced by compression between said two abutting surfaces from 5% to 40% of its initial thickness.

#### SUMMARY OF THE INVENTION

**[0023]** In an outlet nozzle of a fluid contained in a container and deliverable under positive pressure, which outlet nozzle possesses a plate with an outlet hole in communication with an outlet delivery line, said plate having collecting channels and possibly formers of the outlet vortex of the impelled fluid, the plate being retained by an insert which laterally describes at least one passage for the fluid contained in a container to which said construction is attached. The insert has a foremost

surface abutting against the inner surface of said front plate, which provides the laterally closing wall of said groove, thereby defining a channel for said fluid in communication with said passage. A membrane made out from an elastically flexible, compressible resilient material is interposed between said inside surface of said plate and the opposite surface of the insert face. This membrane has an annular outer portion that is initially flat, and a centre portion having a projection in bell-shaped dome form at its active surface that abuts against the inside surface of the central plate. The membrane also has a supplementary recess in its opposite surface that faces the insert front surface. The membrane forms in its plane zone an annular hermetic seal which encloses in the space defined by the supplementary recess and insert front surface a small air-tight chamber filled with air. This chamber is deformable under pressure by the deformation of the membrane; and the membrane material is partially forced into any recess or cavity inside zones, including the said groove, thus providing lateral closing wall defining the channel, ensuring the hermetic seal of same along the surface of said membrane. The projecting dome at the centre portion of the membrane is seated against the inside walls of the outlet orifice in the plate, describing an annular seal against said walls of said outlet channel. When the projecting dome is selectively displaced by the pressure of the incident contents against the active surface of the membrane, the sealed chamber increases its compression ratio when deformed by the incident fluid under pressure, providing parts of the return force of said dome shape central part of the membrane against the outlet orifice; establishing deformation of said membrane a space free from interference between the membrane and said outlet orifice

**[0024]** Many embodiments can be designed on the basis of this combination, but for the purpose of providing a preferred embodiment of the invention, the following construction is now described, with the aid of the attached drawings, being this embodiment and drawings provided merely as an example with no limitative purposes to the actual scope of the invention.

**[0025]** Figure 1 represents a cross section of said "most commonly known nozzles" as above explained, without the membrane of the invention. This figure depicts the cross section of a state of the art nozzle. In this figure, the plate (10) has its cross section taken at the plane AA' of Figure 1a;

Figure 1a, shows a plane view of the inner face of the plate, with the most usual array of grooves for the distribution and vortex creation for the fluid;

**[0026]** Figure 2 shows a perspective view of the membrane by itself;

Figure 3 depicts said membrane according to the cross section as per plane BB of Figure 2;

**[0027]** Figure 4 shows said "most commonly known nozzles" provided with the membrane of this invention, in the same cross section, showing its left hand side por-

tion thereof the membrane in its sealing position, while the right hand side part of this same Figure 4 shows the membrane under deformation performed by the fluid pressure, liberating the exit orifice;

**[0028]** Figure 5 shows a cross section of said membrane, pressed and deformed into the cavities and grooves, forming the fourth wall of the channel in the plate with the outlet orifice, according to plane CC' of Figure 4.

**[0029]** The same components and means hereafter mentioned and illustrated are identified in the specification and figures, with the same reference numerals.

**[0030]** The state of the art "most commonly known nozzles" depicted schematically at Figure 1 and 1a, comprehends an outlet plate (10), with an outlet orifice (11) communicating with an outlet duct provided in said plate (10) and secured to the outlet nozzle (1). This plate (10) has at least one collecting groove (12) performed in the inner surface of plate (10) and connecting the periphery (13) of said inner surface of plate (10) with said outlet orifice (11). The construction is completed by an insert body (20) of cylindrical shape, placed into a cavity (2) of said exit nozzle head (1), coaxial to said orifice (11) of plate (10), determining the cylindrical walls (21) of the lateral surface of said insert (20) at least a passage (22) with said cavity, communicating this passage with a pump (not shown) and with the peripheral channel (13). The inner face of the outlet plate (10) abuts and is generally pressed against the foremost surface (23) of the insert body (20), thus defining the collecting channels (24) when faced with said grooves (12). There are no hermetic seals provided in said "most commonly known nozzles" because these state of the art constructions did not required them.

**[0031]** This invention provides a closing and air tight seal performing against the inner lips of the outlet orifice without modifying the above said known constructions. That is, any manufacturer can apply this membrane thus transforming its state of the art product into a novel nozzle head capable of a sealing and air-tight closing action against the outlet orifice.

**[0032]** This instant invention is characterized by the interposition of a membrane made out from an elastically flexible, compressible resilient material placed between said inside surface of said plate and the opposite surface of the insert face. Figure 2 shows said membrane (50) in a simplified perspective view. This membrane has a general disk form shape, with an annular outer portion thereof (51) which is coplanar and generally "floppy", that is, it adapts itself easily to any other shape by elastic deformation when pressed or otherwise solicited. The centre of said membrane has on one of its faces a bell shaped projection (52), and the opposite face has a corresponding concavity (53). This bell shaped projection is more resilient than said annular floppy portion (51), due to its shape. Said membrane has an annular outer portion thereof (51) which is initially flat, while at its centre portion it has a projection in bell-

shaped dome form (52) at its active surface which abuts against the inside surface of the central plate. The membrane has a supplementary recess (53) in its opposite surface that faces the insert front surface (23). Said membrane is strongly pressed in its flat annular outer portions (51) against the inside surface of the plate by said insert (20), producing a flat annular hermetic seal in their two respective annular surfaces in the annular zone of the membrane thus pressed, being the membrane material (54) partially forced into any recess or cavity in said zones, including said groove (12), thus providing the lateral closing wall defining the channels (24), ensuring the hermetic seal of same along the surface of said membrane. Said projecting dome (52) at the centre portion of the membrane is seated against the inside walls of the outlet orifice (11) in the plate, describing an annular seal against said walls of said outlet channel. The projecting dome is selectively displaceable by the pressure of the incident contents against the active surface of the membrane (see arrows P, in Figure 4). Said membrane forms a small sealed air chamber (55) against the foremost surface (23) of the insert, being this sealed chamber annularly delimited by the flat zone of the membrane pressed between the insert and plate, and initially filled with air at atmospheric pressure. The sealed chamber has a volume with a compression ratio of 25 to 50% of its volume when deformed by the incident fluid under pressure, this compression providing part of the return force of the dome shape central part of the membrane to its sealing position against the outlet orifice. This membrane has a thickness, before compression, of between 0,03mm up to 1mm, having its thickness reduced by compression between said two abutting surfaces from 5 to 40% of its initial thickness, while its diameter is compatible with the inner diameter of the circular collecting channel (13) in the plate against which it rests.

**[0033]** The front surface (23) of the insert (20) can have a small depression (56) which helps to regulate the return force due to the air compression into this small air chamber.

It is also noticed that in this instant invention, and quite contrary to the teachings of the known prior art (see eg. FRENCH patent mentioned above), the membrane has a small compression chamber (55), which has an area about 30% to 70% of the total area of the membrane, while part of the membrane remains locked by compression between the abutting components (10-20), and it is only free to flex or hinge at the initial base of the bell shaped dome (52), which does not allow for a distribution of the tensions due to deformation of this dome under pressure, and further helps to aid in the return sealing force of said dome against said orifice (11).

**[0034]** Figure 5 helps to illustrate another unique feature of this invention, not to be found in any of the cited prior art. Membrane (50) is strongly pressed in its flat annular outer portions (51) against the inside surface of the plate (10) by said insert (20), producing a flat annular

hermetic seal in their two respective annular surfaces in the annular zone of the membrane thus pressed, being the membrane material (54) partially forced into any recess or cavity in said zones, including said groove (12), thus providing the lateral closing wall defining the channels (24) (figure 2), ensuring the hermetic seal of same along the surface of said membrane. This is an unique feature, since otherwise if this membrane would be incapable of being deformed into the parts (54), it would be impossible to ensure the air-tight seal of the walls completing the channels (24) (figure 2), which is provided by the abutting face of said membrane. The ratio within which the membrane material can be pressed and thus deformed varies from 5% to 40 % of the initial thickness of the membrane.

## Claims

1. An elastically flexible membrane acting as an outlet channel stopper of a nozzle for a fluid under pressure having a plate with an outlet hole in communication with an outlet delivery line, said plate having collecting channels and a method for dispersion at the outlet of the impelled fluid, the plate being retained by an insert which laterally describes at least one passage for the contents of the container, wherein said elastically flexible membrane is insertable between the inside surface of said plate and the opposite surface of the insert facing it, said elastically flexible membrane having a projection in bell-shaped dome form in the central portion of its active surface which abuts against the inside surface of the plate with said outlet hole, which describes a supplementary recess in the opposite surface of the membrane; said elastically flexible membrane being pressed the inside surface of the plate and respectively against the free surface of said insert by said insert body, creating a hermetic seal in its two respective opposite surfaces in the zones of the membrane thus pressed against; said projecting dome being seated against the inside walls of the outlet channel made inside plate, describing an annular seal against said outlet channel, said projecting dome selectively displaceable by the pressure of the incident contents against the active surface of the membrane into an open position, said membrane forming a sealed air chamber against the surface of the insert, compressible by deformation of said bell-shaped projection said air chamber supplying a portion of the force needed to restore the membrane into a closed position.
2. The membrane according to claim 1, wherein said membrane material is partially pressed against a recess or projection on the insert or plate surfaces, adjacent to said membrane, including said group, providing the closing wall of said groove thus defin-

ing a channel with said groove which is hermetically sealed along the abutting surface of said membrane.

3. The membrane according to claim 1, wherein said hermetically sealed chamber defined between said abutting membrane and insert is formed by a pressure exerted against said membrane by said insert. 5
4. The membrane according to claim 1, wherein said hermetically sealed chamber defined between said abutting membrane and insert is formed by a perimetrical annular heat sealing of the membrane against said insert surface. 10
5. The membrane according to claim 1, wherein said membrane is made from a material which is different from the material from which said nozzle, insert or plate are made. 15
6. The membrane according to claim 1, wherein said membrane is forming an annular closed hermetically sealed small chamber and said insert has a small depression facing said membrane. 20
7. A spray nozzle for a container comprising 25
  - An outlet nozzle with a front plate with an outlet orifice in communication with an outlet delivery line, said plate having an inner face having collecting grooves of an outlet vortex of an impelled fluid; 30
  - An insert retaining said plate and which laterally describes at least one passage for said fluid contains in said container, said insert having a foremost surface abutting against said inner surface of said front plate and providing the laterally closing wall of said collecting grooves, defining a channel for said fluid in communication with said passage; 35
  - An elastically flexible, compressible resilient membrane insertably retained between said inside surface of said plate and the opposite surface of the insert face; said membrane having an annular outer portion that is initially flat; a projection at its centre portion in bell-shaped dome form at its active surface which abuts against the inside surface of the central plate, said membrane forming a supplementary recess in its opposite surface and said insert front surface; an annular hermetic seal enclosing a small air chamber, said air chamber being deformable under pressure by the deformation of said membrane; said projecting dome being seated against the inside walls of the outlet orifice in the plate, describing an annular seal against said walls of said outlet channel, said projecting dome selectively displaced by the pressure of the incident contents against the active surface of the membrane; 40
  - said sealed chamber increasing its compression ratio when deformed by the incident fluid under pressure, providing part of the return force of said dome 45

shape central part of the membrane against the outlet orifice; establishing from the deformation of said membrane a space free from interference between the membrane and said outlet orifice through which said contents can flow.

8. A flexible outlet channel stopper membrane adaptable to existing spraying nozzles of the kind comprising an outlet nozzle with a front plate with an outlet orifice in communication with a delivery line, said plate having in its inner face collecting grooves of an outlet vortex of the impelled fluid, the plate being retained by an insert which laterally describes at least one passage for the fluid contained in a container to which said construction is attached, having said insert a foremost surface abutting against the inner surface of said front plate and providing laterally closing wall of said groove, defining a channel for said fluid in communication with said passage, said membrane comprising
  - An elastically flexible, compressible resilient material insertably retained between said inside surface of said plate and the opposite surface of the insert face;
  - An annular outer portion that is initially flat;
  - A projection at its centre portion in bell-shaped dome form at its active surface which abuts against the inside surface of the central plate, said membrane forming a supplementary recess in its opposite surface and said insert front surface;
  - an annular hermetic seal enclosing a small air chamber, said air chamber having a surface area about 30 to 70% of the total surface area of the membrane, said air chamber being deformable, under pressure by the deformation of said membrane; said projecting dome at the centre portion of the membrane being seated against the inside walls of the outlet orifice in the plate, describing an annular seal against said walls of said outlet channel, said projecting dome selectively displaced by the pressure of the incident contents against the active surface of the membrane; said sealed chamber increases its compression ratio when deformed by the incident fluid under pressure to a range of between 25 and 50 %, providing part of the return force of said dome shape central part of the membrane against the outlet orifice; establishing the deformation of said membrane a space free from interference between the membrane and said outlet orifice.

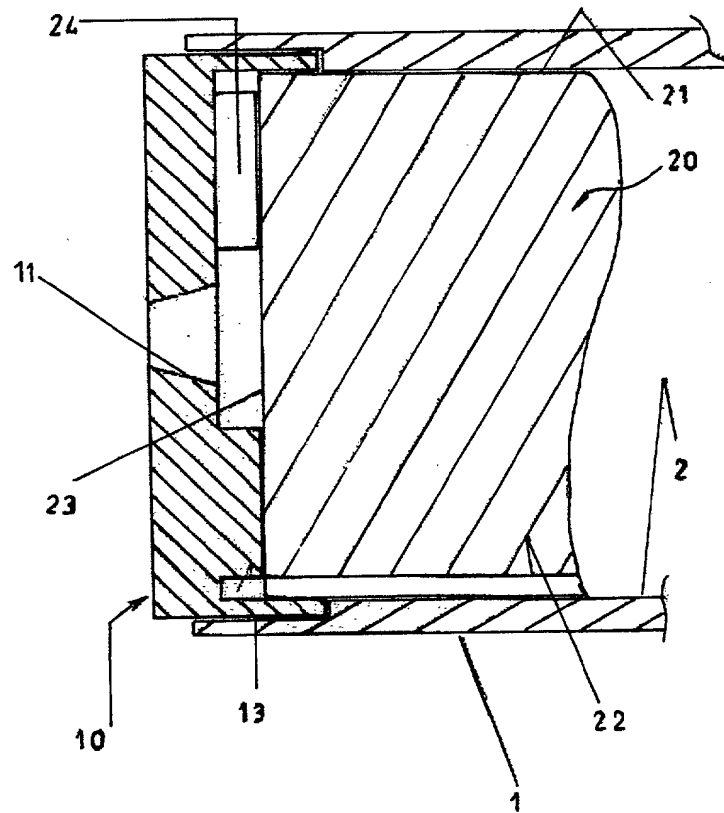


FIGURE 1

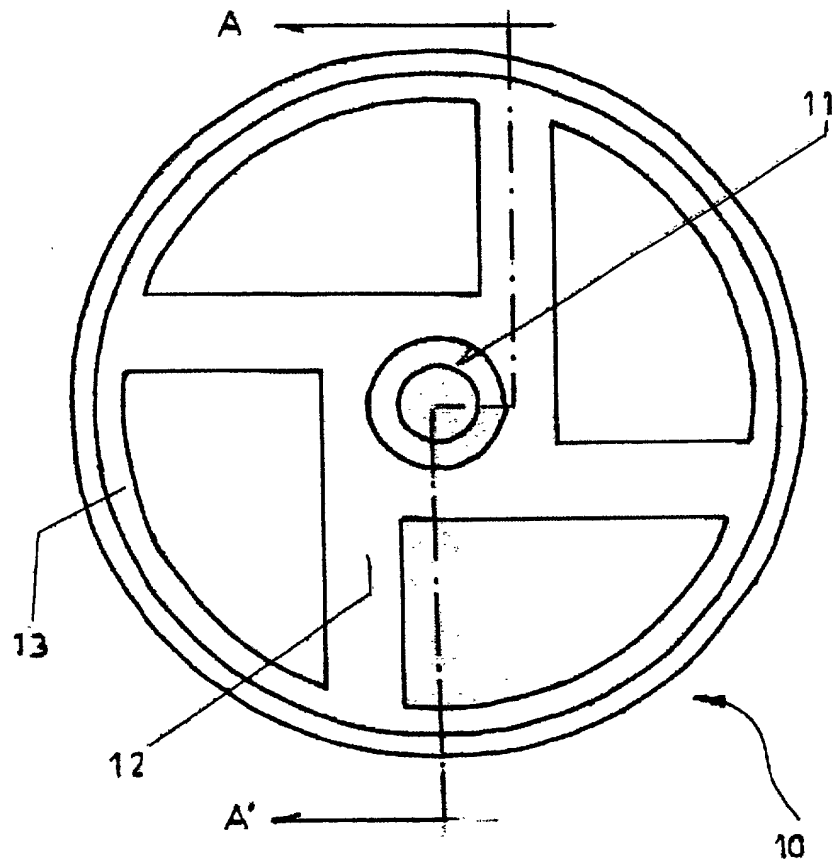
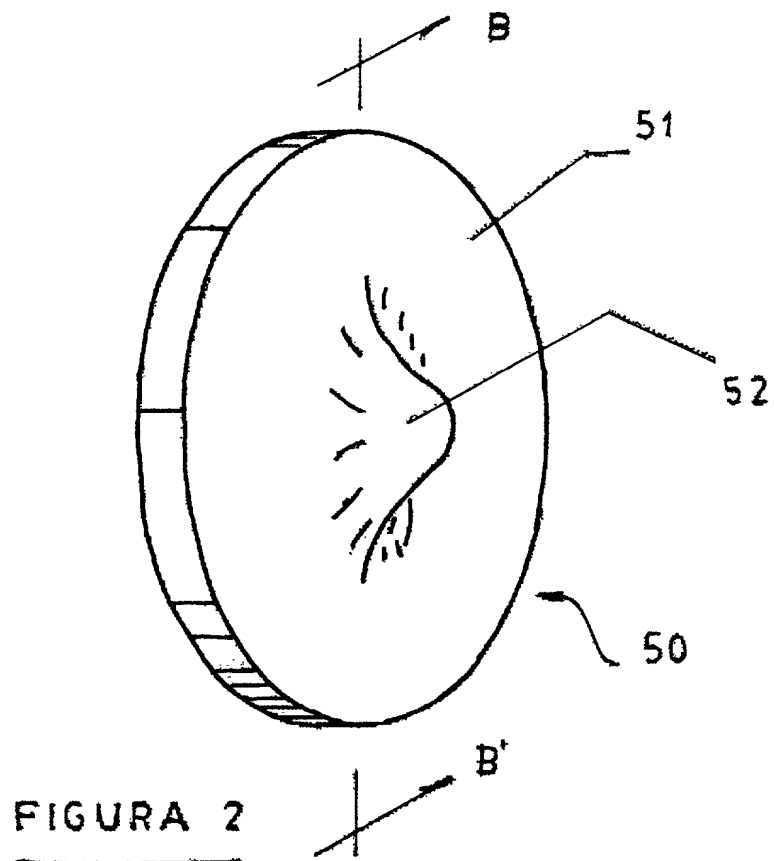
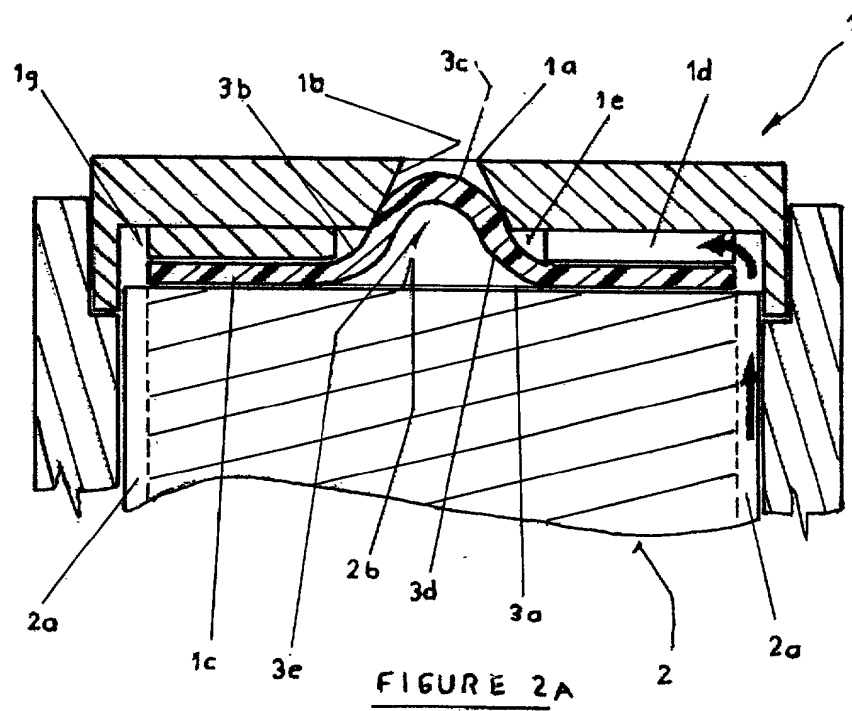
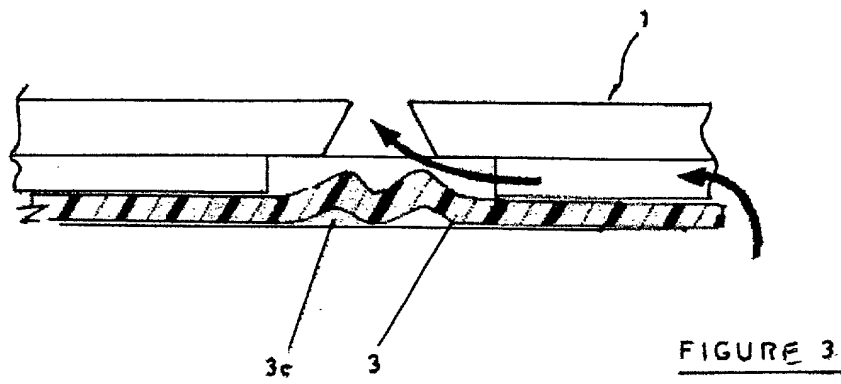


FIGURE 1a









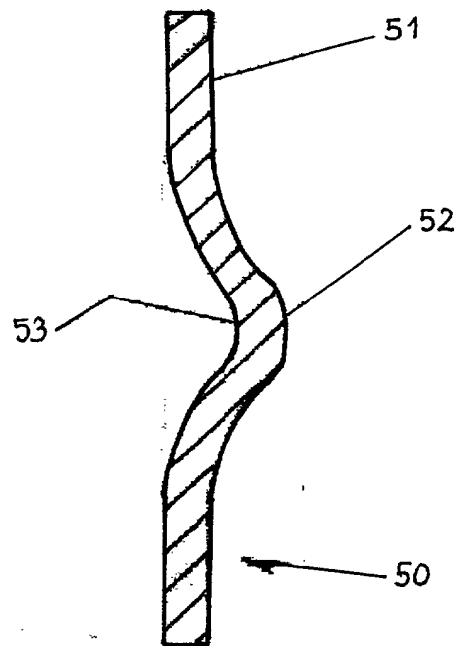
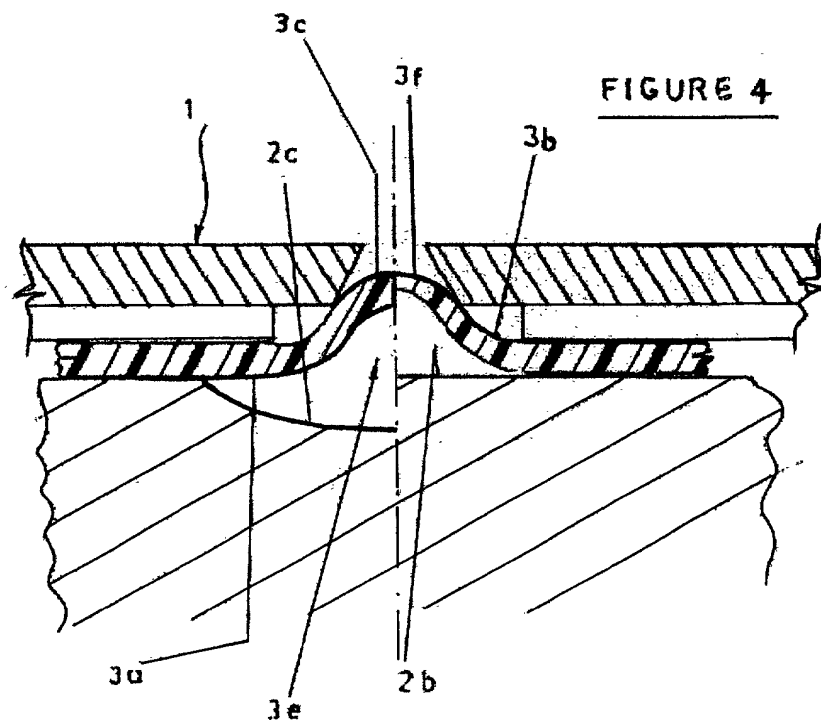


FIGURE 3A



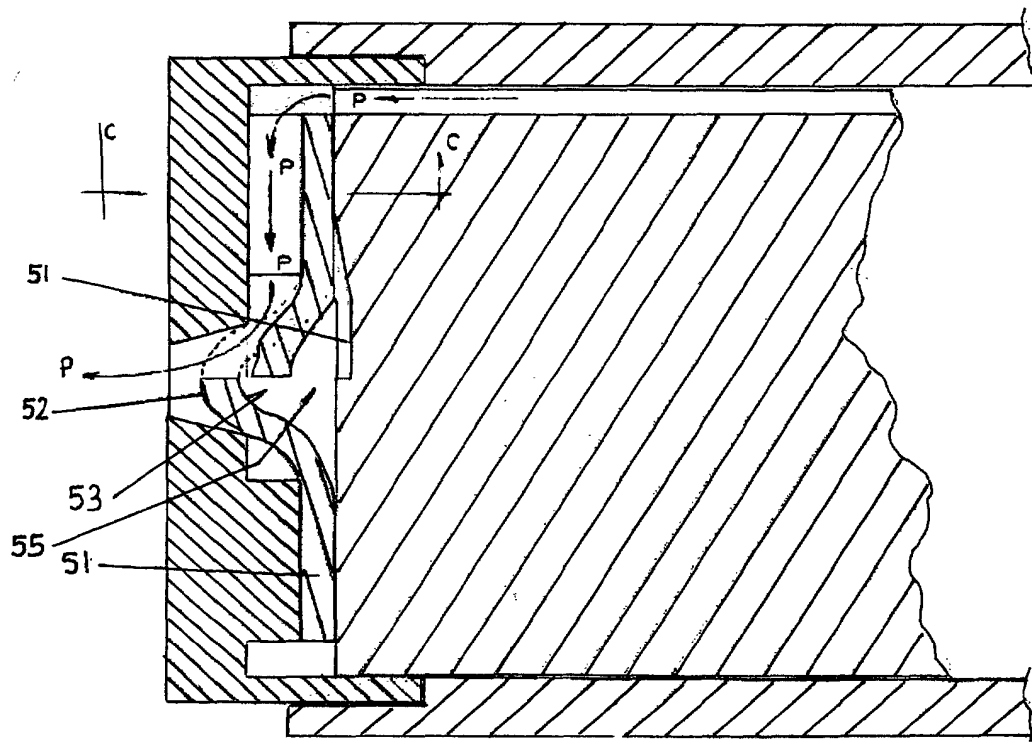


FIGURE 4A

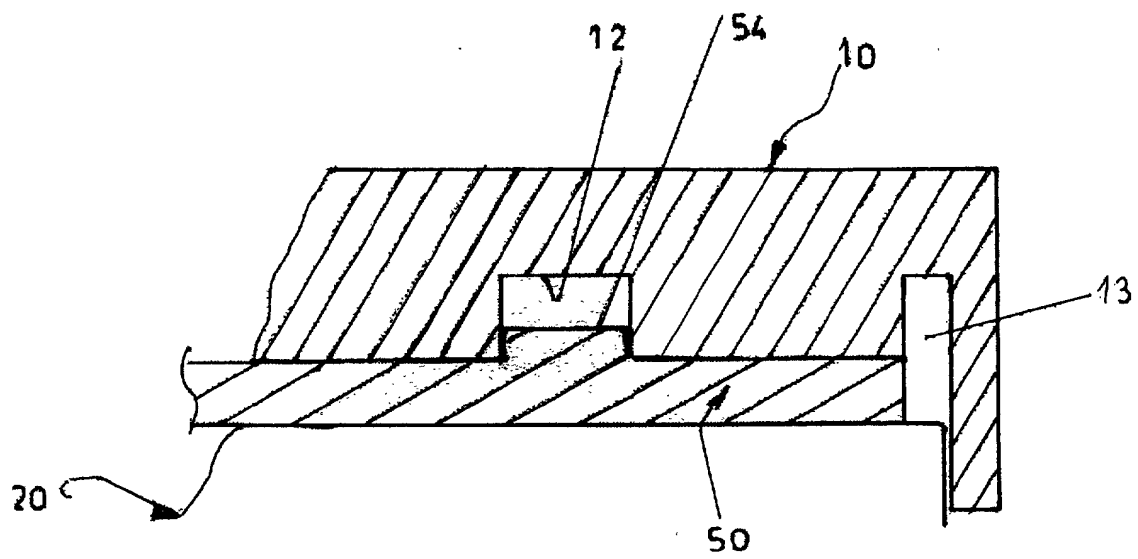


FIGURE 5



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## EUROPEAN SEARCH REPORT

Application Number  
EP 02 38 0015

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B05B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21 May 2002	Examiner Jelercic, D
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EPO FORM 1503 03/92 (P04G01)



**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 02 38 0015

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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